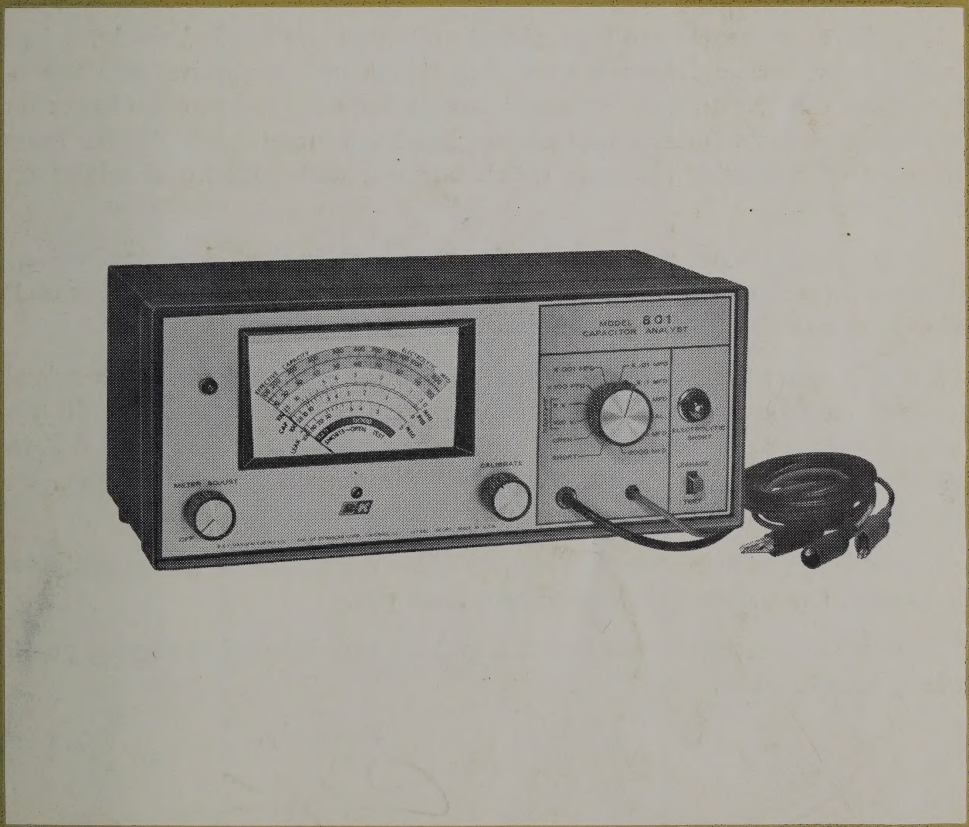
INSTRUCTION MANUAL

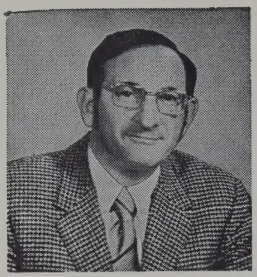
B&K MODEL 801

CAPACITY ANALYZER



B&K

Product of DYNASCAN CORPORATION
1801 West Belle Plaine Avenue, Chicago, Illinois 60613



Dear Friend:

Congratulations on your purchase of B & K—Precision Test Equipment, and welcome to the B & K family. We hope your experience with your new test equipment will make you a lifetime B & K customer.

Your instrument is backed by more than 20 years of experience in designing and manufacturing. Our most important goal is your satisfaction. At B & K, test equipment is made to meet the demands of the field focusing on dependability and accuracy. We also concentrate on simplicity and operating ease with features that reduce the possibility of human error and speed the servicing process.

In order to determine the type of test units that are needed we have been guided by letters and reports from technicians and engineers who use the equipment daily. Our field tests and studies have helped provide better and faster service techniques. Close contact has been maintained with the manufacturers of consumer products which our test units will be checking and trouble-shooting.

Key personnel in our company cut their eye teeth in the TV service business. This is why we have more "sensitivity" for the problems and conditions under which the test equipment will be used.

B & K product designs are constantly reviewed, and refinements are made or new models developed to meet advances in our industry and to fill your needs. We set our standards high so you can be assured that the B & K test instruments you buy represent advanced design, quality construction, and dependable long-term performance at a price you can afford.

If you have any comments or thoughts about our products, or test equipment in general, I would be delighted to hear from you.

Thanks for your confidence in B & K and we look forward to serving you for a long time to come.

Sincerely,

Carl Korn
President

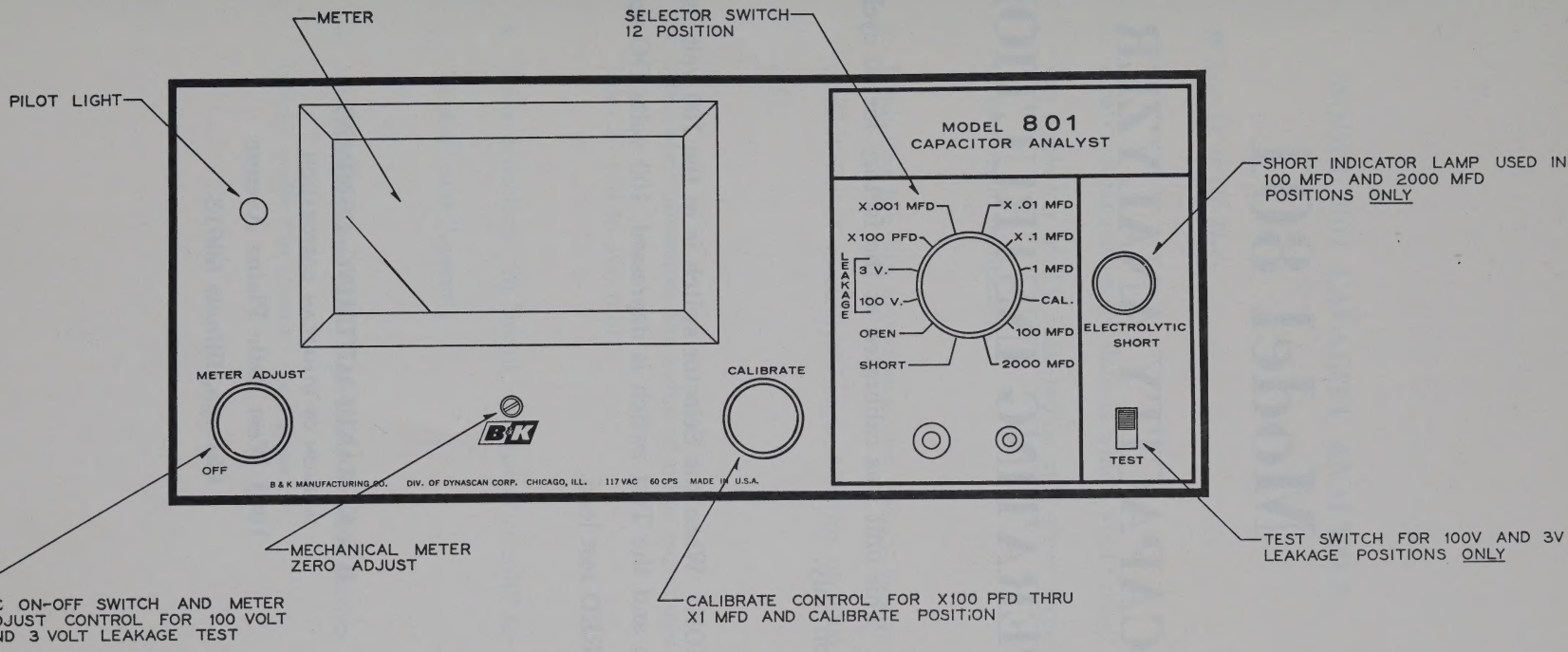


FIGURE 1. CONTROL LOCATIONS

Model 801

CAPACITY ANALYZER

OPERATING INSTRUCTIONS

NOTE: This unit was calibrated at the factory for 60 cycle AC operation only.

CAUTION: When the Selector switch is in the 100 volt leakage position and the Test switch is depressed, 100 volts DC appears on the RED test lead.

B & K MANUFACTURING COMPANY
DIVISION OF DYNASCAN CORPORATION

1801 West Belle Plaine Avenue
Chicago, Illinois 60613

MODEL 801 CAPACITY ANALYZER

What It Will Do:

1. Analyzes capacitors for defects which would affect the operation of TV sets, radios and other forms of electronic equipment.

2. Evaluates the life expectancy and energy storing capabilities of electrolytic capacitors up to 2000 mfd.

3. Accurately measures the value of other capacitors from 25 pfd to 100 mfd.

4. Tests capacitors "in circuit" or "out of circuit" for "shorts" and "opens".

5. Measures leakage of all capacitors (except electrolytics) under "in circuit" conditions.

MODEL 801

CONDENSED OPERATING INSTRUCTIONS

Read your instruction manual thoroughly before using these condensed operating instructions. If a test result is questionable, refer back to your instruction manual for more detailed information.

Disconnect all power from equipment to be checked.

TESTS 1, 2, 3 & 4 DO NOT APPLY TO ELECTROLYTICS.

CAUTION: This unit was factory calibrated for 60 cycle AC operation only. When the Selector switch is in the 100 volt leakage position and the test switch is depressed, 100 volts DC appears on the RED test lead.

1. SHORT TEST: (in or out of circuit) Rotate *selector* to SHORT—Connect BLUE & BLACK leads to capacitor—Read GOOD-BAD scale—See page 4 in manual.

2. OPEN TEST: (in or out of circuit) Rotate *selector* to OPEN—Connect BLUE & BLACK leads to capacitor, close to body—Read GOOD-BAD scale—See page 5 in manual.

3. LEAKAGE TEST: (out of circuit) Disconnect one capacitor lead if in circuit —Rotate *selector* to appropriate LEAKAGE position—Connect RED & BLUE leads to capacitor—Rotate *meter adjust* for Inf. (infinity) on leakage scale of meter—Depress test switch and read leakage resistance, in megohms, on leakage scale.

   NOTE: for "in circuit" leakage measurements see pages 6, 7 & 8 in manual.

4. CAPACITY VALUE TEST: (out of circuit) Disconnect one capacitor lead if in circuit—Rotate *selector* to desired capacity range—Adjust *calibrate* control for full scale on meter (test leads must not be touching)—Connect BLUE & BLACK leads to capacitor, close to body—Read value on scale marked PFD or MFD—See page 9 in manual.

5. ELECTROLYTIC CAPACITOR TEST: (out of circuit) Disconnect one capacitor lead if in circuit—Rotate *selector* to CALIBRATE—Adjust *calibrate* control for full scale—Connect BLUE lead to positive side of capacitor—Connect BLACK lead to negative side—Rotate *selector* to desired range—Read value on blue meter scales.

   If *electrolytic short* lamp glows brightly with no meter reading, capacitor is SHORTED. If the lamp does not glow and there is no meter reading, capacitor is OPEN. See pages 10 & 11 in manual.

SHORTS TEST

"IN CIRCUIT" MEASUREMENT

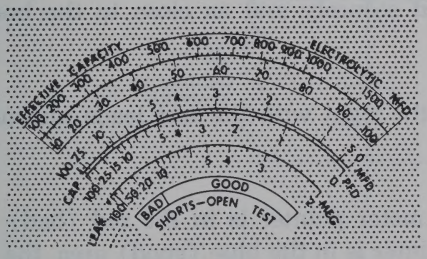
NOTE: This test is accurate for all normal television and electronic circuits. In the rare case where the capacitor being tested is shunted by less than 25 ohms (practically a short), the capacitor should be tested out of the circuit.

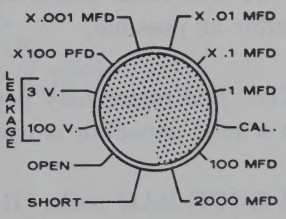
1. Remove all power from the circuit in which the capacitor to be tested is located.
2. Rotate the *Selector* switch to the SHORT position. See Figure 1.
3. Connect the BLUE and BLACK test leads to the leads of the capacitor.
4. Read GOOD-BAD scale. If the meter pointer is in the blue (good) area of the scale, the capacitor is not shorted. If the meter pointer is in the red (bad) area, the capacitor is shorted.

NOTE: A good capacitor may peg the meter to the right.

"OUT OF CIRCUIT" MEASUREMENT

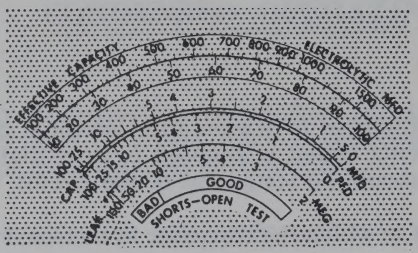
Disconnect one lead of the suspected capacitor and perform the above steps.

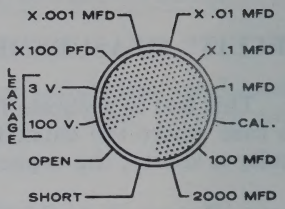




SCALE & SELECTOR LOCATION FOR SHORTS TEST

OPENS TEST





SCALE & SELECTOR LOCATION FOR OPENS TEST

"IN CIRCUIT" MEASUREMENT

NOTE: This test is accurate for all normal television and electronic circuits with the following exceptions: If the capacitor is less than 25 pfd, the meter will show open (or bad)—If the shunting resistance is less than 50 ohms, the capacitor will show open. If either of these conditions exist the capacitor should be tested out of the circuit. DO NOT TEST CAPACITORS BELOW 25 pfd in circuit. THEY WILL TEST "BAD" EVEN THOUGH THEY MAY BE PERFECTLY GOOD.

1. Remove all power from the circuit in which the capacitor to be tested is located.

2. Rotate the *Selector* switch to the OPEN position.

3. Connect the BLUE and BLACK test leads to the leads of the capacitor. Be sure the test leads are connected securely and as close to the body of the capacitor as possible.

   NOTE: The meter may peg to the right with the test leads unconnected or when a good capacitor is tested.

4. Read GOOD-BAD scale. If the meter pointer is in the red (bad) area, the capacitor is open. If the meter pointer is in the blue (good) area, the capacitor is not open.

"OUT OF CIRCUIT" MEASUREMENT

Disconnect one lead of the suspected capacitor and perform the above steps.

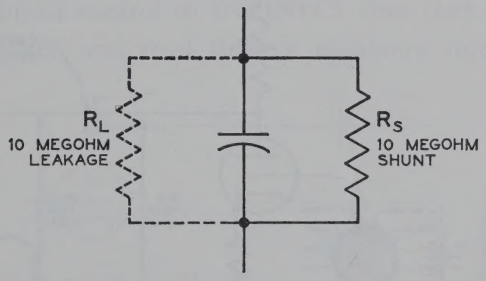
LEAKAGE TEST

NOTE: To test leakage of Electrolytics see page 10.

A capacitor that is neither shorted nor open will indicate some leakage resistance, but it is the amount of leakage that determines whether or not a capacitor should be replaced. Generally, a capacitor whose leakage has dropped below 100 megohms should be replaced as a safety precaution because it is deteriorating or has become marginal. If the leakage resistance is 20 to 25 megohms or less, the capacitor is defective and should be replaced. Ceramic capacitors are the exception to this rule because of their inherent low leakage resistance.

In using the Model 801 for "in circuit" leakage resistance measurements, a resistance should not be connected across the capacitor under test because this instrument cannot distinguish between leakage resistance in a capacitor and a shunting resistance connected externally across the capacitor.

EXAMPLE: If a capacitor shunted by a 10 meg resistor indicates a reading of 5 megohms on the meter, its actual leakage resistance is 10 megs because two 10 megohm resistors in parallel result in 5 megohms of total resistance. If a shunting resistor does exist, its effect must be treated as though the capacitor leakage resistance and shunting resistor R_s formed a parallel resistive circuit.



CAUTION: When the *Selector* switch is in the 100 VOLT LEAKAGE position and the *Test* switch is depressed, 100 Volts DC appears on the RED test lead. Proper safety precautions should be taken while performing this test. A discharge circuit has been incorporated into the 801 to discharge capacitors after they have been tested in this position.

LEAKAGE TEST

COUPLING CAPACITORS. See Figure 2.

1. Remove all power from the circuit in which the capacitor to be tested is located.
2. Connect the RED test lead to the input or plate side of the capacitor. Connect the BLACK test lead to Ground.
3. Rotate the *Selector* switch to 100 VOLT LEAKAGE if the voltage rating of capacitor is 100 volts or greater, or to 3 VOLT LEAKAGE if voltage rating of capacitor is between 3 volts and 100 volts (capacitors with less than 3 volt rating should not be tested).
4. Adjust *Meter Adjust* control (on front panel) until meter pointer is at INFINITY line (left side of meter).
5. Connect the BLUE test lead to the output or grid side of the capacitor.
6. Depress *Test* switch and read leakage resistance directly from meter in megohms on leakage scale.

NOTE: See Figure 2. When operating at 100 volts, if R2 is below 130K and/or R1 is less than 10K, meter accuracy will be slightly off. When operating at 3 volts, R2 should be several megohms to attain accurate results. The important concern here is whether enough leakage exists in a capacitor to cause trouble in a circuit and the Model 801 will always indicate this.

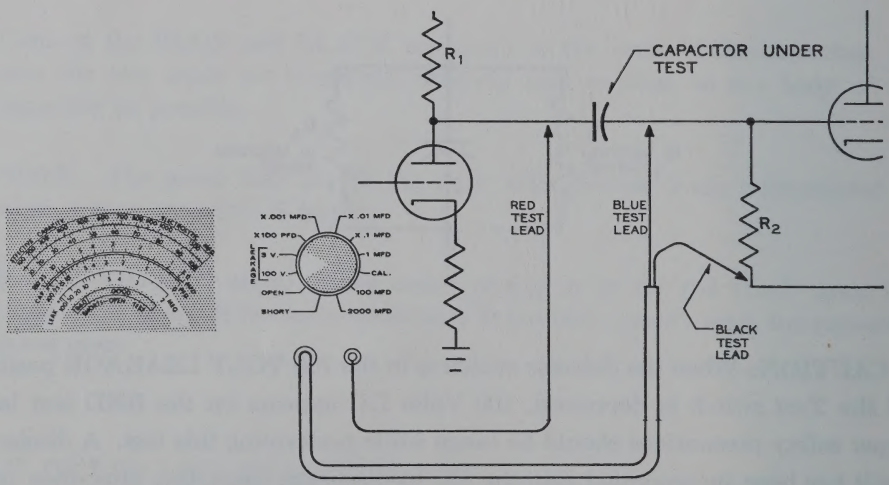


FIGURE 2. LEAKAGE TEST FOR COUPLING CAPACITORS.

LEAKAGE TEST

"IN CIRCUIT" TEST FOR BY-PASS OR OTHER CAPACITORS WITH ONE SIDE GROUNDED. See Figure 3.

NOTE: If the capacitor under test is by-passing a resistor going to B+ then one lead must be disconnected.

The BLACK test lead is not used in this test.

1. Remove all power from the circuit in which the capacitor to be tested is located.
2. Connect the BLUE test lead to the ground side of the capacitor. Connect the RED test lead to the side above ground.
3. Set *Selector* switch to 100 VOLT LEAKAGE if voltage rating of capacitor is above 100 volts, or to 3 VOLT LEAKAGE if rating of capacitor is between 3 volts and 100 volts.
4. Adjust *Meter Adjust* control (on front panel) until meter pointer is at INFINITY line (left side of meter).
5. Depress *Test* switch and read leakage resistance directly in megohms on Leakage scale.

TESTING CAPACITORS "OUT OF CIRCUIT"

NOTE: The BLACK test lead is not used in this test.

1. Disconnect one capacitor lead if in circuit.
2. Connect the BLUE and RED test leads to the leads of the capacitor.
3. Rotate *Selector* switch to 100 VOLT LEAKAGE if voltage rating of capacitor is above 100 volts, or to 3 VOLT LEAKAGE, if rating of capacitor is between 3 volts and 100 volts.
4. Rotate *Meter Adjust* control to INFINITY line (left side of meter).
5. Depress *Test* switch and read leakage resistance directly in megohms on Leakage scale.

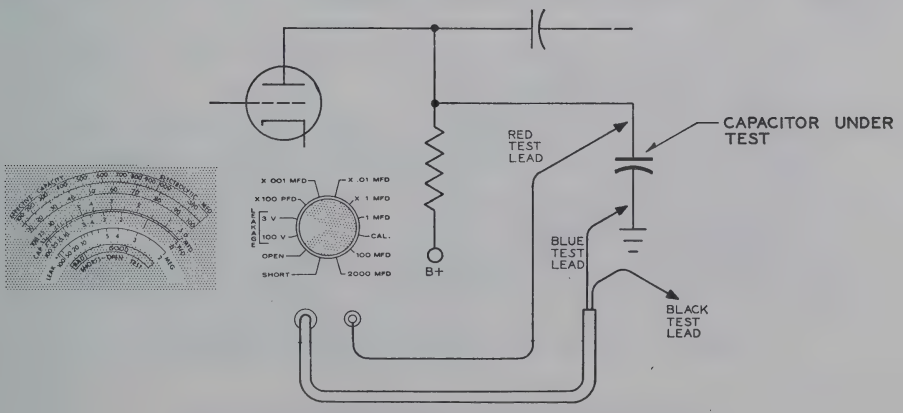


FIGURE 3. LEAKAGE TEST FOR BY-PASS CAPACITORS.

CAPACITY VALUE TEST

(from 25 pfd to 100 mfd)

NOTES: The capacitor to be measured must be out of the circuit or have one end disconnected for this test. The RED test lead is not used in this test.

1. Set the *Selector* switch to the appropriate multiplier range.

2. Adjust *Calibrate* control for (zero) full scale reading on the meter face. Be sure the test leads are not in contact with each other. Do not hold the test leads on very low capacity measurement because hand capacity will cause an inaccurate reading.

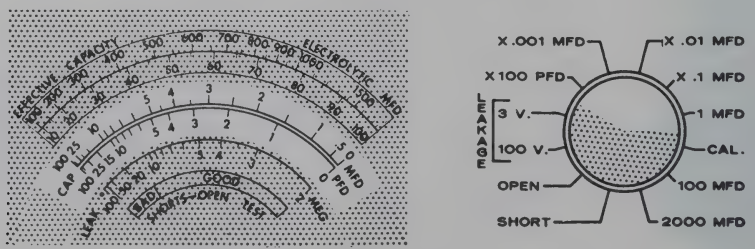
3. Connect the BLUE and BLACK test leads to the leads of the capacitor.

4. Read the value indicated on the meter face and multiply by the value of the range.

Capacity measurements may be made on any type of capacitor (except electrolytics which are evaluated in another test) as long as it falls within the range of the Model 801 and has a working voltage of 3 volts or more. This permits testing low voltage transistor circuit capacitors as well as those used in vacuum tube circuits.

INTERPRETING THE METER SCALES:

Capacitors whose values range between 0 and 10,000 pfd may be read on the PFD scale. Capacitor with values between 0 and 100 mfd are read on the MFD scale. For greatest accuracy, it is recommended that capacitor values greater than 1500 pfd be read on the MFD scale with the selector switch in the X .001 range. A picofarad (PFD) is equivalent to a micromicrofarad.



SCALE & SELECTOR LOCATION FOR CAPACITY VALUE TEST

EXAMPLES: If the meter indicates 3 on the microfarads scale with the *Selector* switch in the *X .001 MFD* position, the capacitor has a value of 3 X .001 = .003 mfd.

If the meter reads 30 on the same scale, the value of the capacitor will be 30 X .001 = .03 mfd.

If the meter reads 4 on the picofarads scale with the *Selector* switch in the *X 100 pfd* position, the capacitor has a value of 4 X 100 = 400 pfd.

ELECTROLYTIC CAPACITY TEST

NOTE: All electrolytic capacitors must be checked out of circuit. If the rated value of the electrolytic is less than 10 MFD, make the value test on the X1 MFD range.

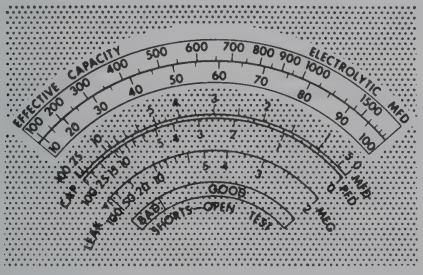
1. Disconnect one end of the capacitor to be tested if it is in circuit.

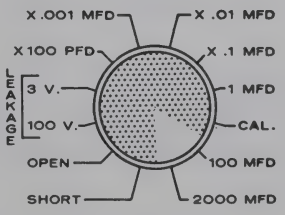
2. Set the *Selector* switch to CALIBRATE, and adjust the *Calibrate* control on the front panel for full scale reading on the meter.

3. Connect the BLUE test lead to the + terminal of the capacitor. Connect the BLACK lead to the − terminal of the capacitor. The RED lead is not used.

4. Set the *Selector* switch to the desired capacity range (100 mfd or 2000 mfd).

5. Read capacity directly on one of the top scales. If the capacitor has been properly formed, the reading will be an accurate indication of the actual storage ability of the capacitor. If it is more than 20% below the rated capacity, it is "BAD" and should be replaced. The amount of leakage in the capacitor is automatically computed into the meter reading.





SCALE & SELECTOR LOCATION FOR ELECTROLYTIC TEST

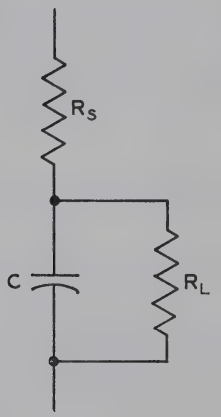
If no reading is observed on the meter, and the *Electrolytic Short lamp* glows very brightly, the capacitor is shorted.

If no reading is observed on the meter, and the *Electrolytic Short lamp* does not light at all, the capacitor is open.

This test should especially be made whenever new rectifiers are installed, as they tend to place a heavy load on the filter capacitors which will shorten their useful life.

The Model 801 actually tests the ability of an electrolytic capacitor to perform the function for which it was designed—store up energy on one half cycle and return it to the circuit on the other half cycle. How well an electrolytic does this job is determined by its capacity size, leakage resistance (dielectric resistance), and its equivalent series resistance (internal resistance of plate and lead material and lead connections).

From the diagram it is obvious that the equivalent series resistance (R_S) reduces the amount of energy the capacitor can absorb during the charging half cycle. Also, the limited energy that was stored is further attenuated on the discharge half cycle by the leakage resistance (R_L). The end result is a reduction in the capacity of the electrolytic.



The capacity, leakage resistance and equivalent series resistance are all measured in one reading by a unique test circuit in the Model 801. This reading tells you the "effective capacity" actually available to do the job.

Electrolytic capacitors normally have a tolerance of — 20% to + 100%, therefore a reading higher than anticipated may be observed. If the meter indicates a value of "effective capacity" 20% below capacitor's rated value, that capacitor should be replaced because it is less than marginal and cannot do a proper job of filtering.

You may notice that some of the higher value capacitors cause the *Electrolytic Short lamp* to glow dimly. This should not be interpreted as a "short" condition. When "shorted," the meter will indicate zero capacitance.

Model 801

CALIBRATION

AND

CIRCUIT DESCRIPTION

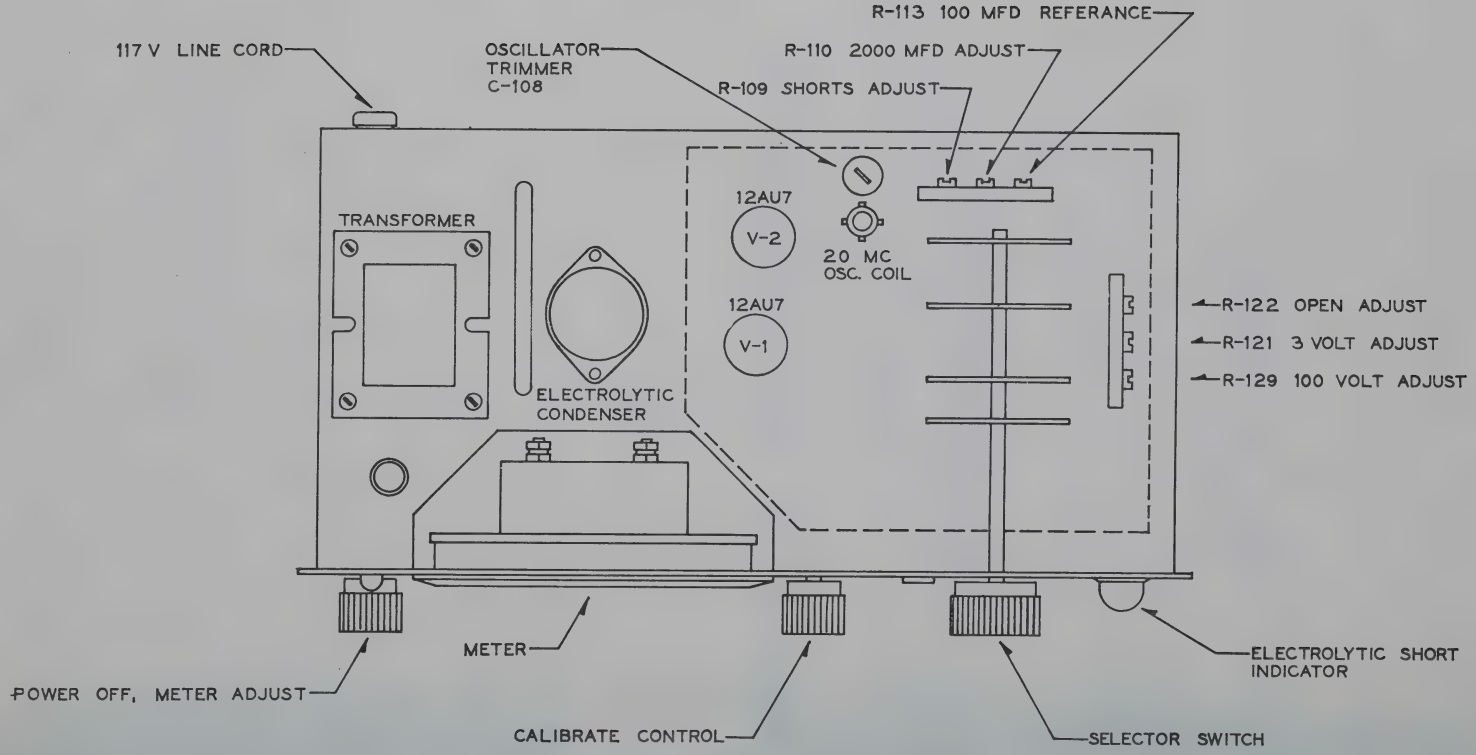


FIGURE 4. INTERNAL ADJUSTMENT LOCATIONS.

"SHORTS" TEST

CALIBRATION. See Figure 4.

1. To calibrate the meter accurately, place a precision 25 ohm resistor across the BLUE and BLACK test leads and adjust the *Shorts Adjust* control until the meter pointer rests on the line separating the red and blue areas of the GOOD-BAD scale.
2. Remove the resistor.

DESCRIPTION. See Figure 5.

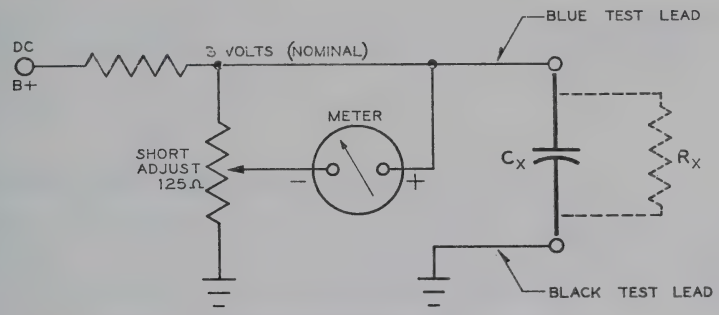


FIGURE 5. SIMPLIFIED SCHEMATIC OF SHORTS TEST.

The capacitor (C_X) under test is virtually placed across the terminals of the meter (M). The voltage at the meter terminals is then shunted by the internal resistance of the capacitor (R_X). If this shunting resistance is less than 25 ohms, the voltage across the meter is reduced to a point where the meter indicates "bad". If the shunting resistance is greater than 25 ohms, the meter will indicate "good". In this test we are assuming anything under 25 ohms is a short.

"OPENS TEST"

CALIBRATION. See Figure 4.

1. Turn control R-122 (open adjust) fully counter-clockwise.
2. Separate BLUE and BLACK test leads. Do not hold onto them during adjustment.
3. Adjust C-108 (oscillator trimmer) for minimum reading on 801 meter (bottom of dip).

   If the dip cannot be observed, rotate R-122 a few degrees clockwise and repeat step 3.
5. Connect a 50 ohm 1% resistor between the BLUE and BLACK test leads. Connect as close to the body of the resistor as possible.
6. Adjust R-122 to the line between BAD and GOOD.
7. Verify that the addition of a 25 pfd capacitor connected in parallel with the 50 ohm resistor causes the needle to read in the GOOD region.

DESCRIPTION. See Figure 6.

The BLUE and BLACK test leads along with L1, C1, and C2 form approximately a quarter wave transmission line at 20 MC that terminates across the secondary of L2. The characteristics of this transmission line are such that a low impedance connected across the open end of the line will be reflected back as a high impedance across L2 secondary. Conversely, a high impedance will be reflected back as a low impedance.

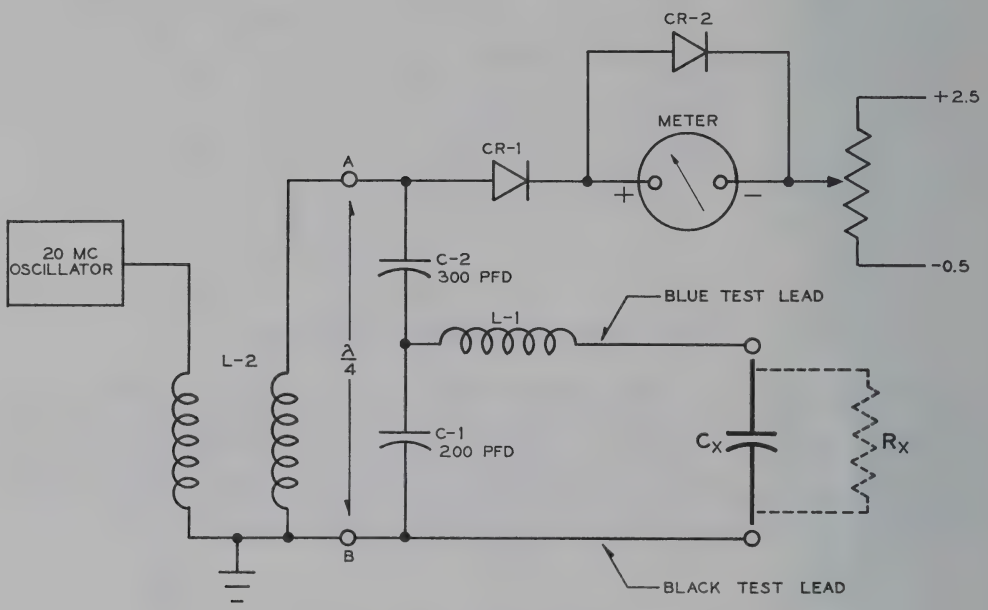


FIGURE 6. SIMPLIFIED SCHEMATIC OF OPENS TEST.

From this it can be seen that if C_X is open (infinite impedance) little or no voltage will be developed across the tank (points A and B) and the meter will register "BAD".

When a capacitor whose value is higher than 25 pfd shunted by 50 ohms is placed across the transmission line (low impedance), it is reflected back through the transmission line as a relatively high impedance across points A and B. This increased impedance causes a like increase in voltage across points A and B. CR_1 rectifies this voltage to drive the meter. The meter will now indicate some value in the "GOOD" area.

LEAKAGE TEST

CALIBRATION. See Figure 4.

1. Rotate the *Selector* switch to the 100 VOLT position.
2. Connect a 5 megohm resistor between the BLUE and RED test leads.
3. Rotate *Meter Adjust* (front panel) control until the meter pointer is at INFINITY at the left of the leakage scale.
4. Depress *Test* switch and adjust *100 Volt Adjust* (R129) for a 5 megohm reading on the leakage scale.
5. Release *Test* switch to see if meter is still at left hand *INF.* Readjust *Meter Adjust* if necessary.
6. Rotate *selector* switch to 3 VOLT position. Depress *Test* switch and rotate 3 *Volt adjust* (R121) for 5 megohm reading on the leakage scale.
7. Remove the 5 megohm resistor.

DESCRIPTION. See Figure 7.

The leakage test consists of a D.C. VTVM which measures the D.C. voltage drop across the internal resistance of C_x and a series resistor, R1. If the internal resistance of the capacitor is infinite, the meter will so indicate when the Test switch is depressed (0 volts). As the internal resistance (R_x) decreases, the voltage across the meter increases proportionately.

The meter is calibrated to give full scale deflection when the internal resistance of the capacitor is 2 megohms or less. This is approximately 0.65 volts.

In the *3 volt Leakage* position, R1 is 820K. In the *100 volt Leakage* position R1 is 12K.

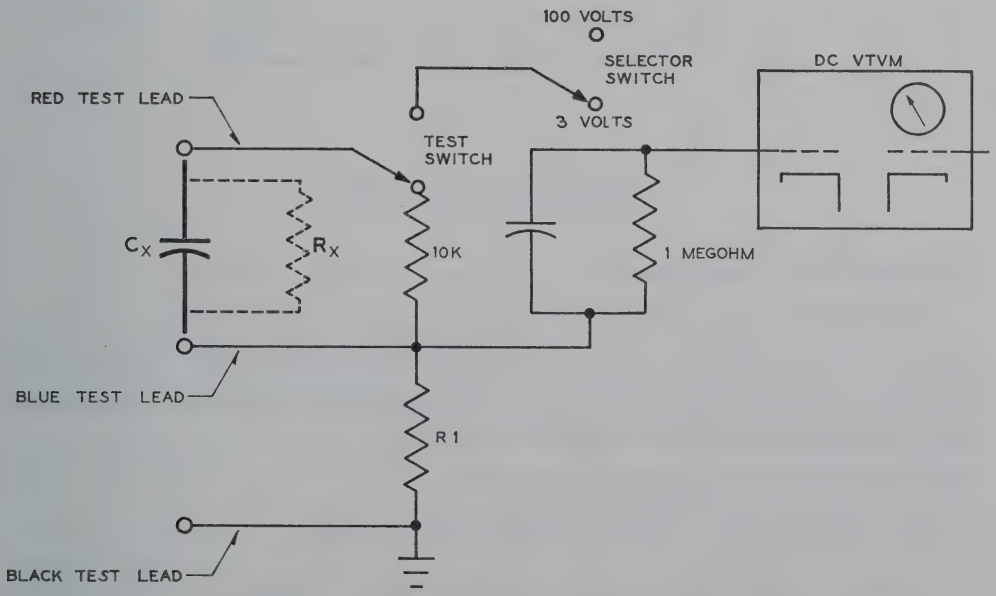


FIGURE 7. SIMPLIFIED SCHEMATIC OF LEAKAGE TEST

"CAPACITY VALUE" TEST

DESCRIPTION. See Figure 8.

The capacity meter is essentially an A.C. VTVM. A full scale of 60 cycle reference voltage is established by the Calibrate control on the front panel while C_x is out of the circuit. When load C_x is connected across the BLUE and BLACK test leads, the voltage across voltage divider R and C_x is lowered in proportion to the reactance of C_x. The higher the capacity, the lower the reactance and, thus, a lower voltage.

This voltage is fed to the grid of a cathode follower whose output is rectified by CR1 and filtered to drive the meter. The resultant D.C. output is relative to the A.C. input voltage. R in the voltage divider will vary with the range chosen by the Selector switch.

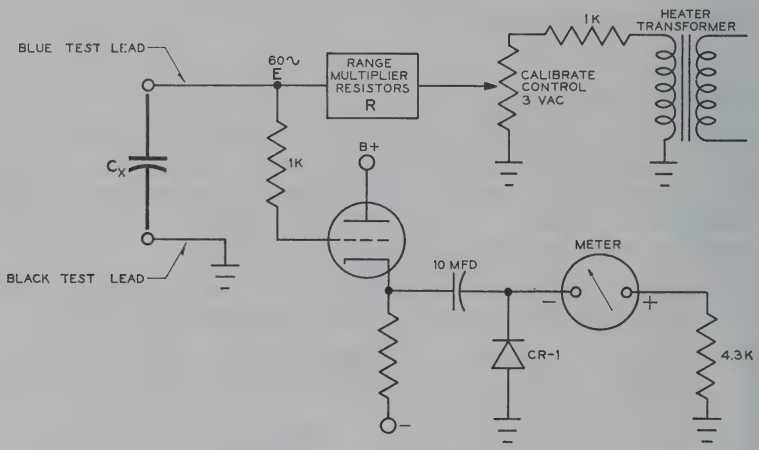


FIGURE 8. SIMPLIFIED SCHEMATIC OF CAPACITY VALUE TEST.

ELECTROLYTIC TEST

CALIBRATION. See Figure 4.

CAUTION: Do not attempt any adjustment of the *100 mfd Reference* (R113) and the *2000 mfd Adjust* (R110) unless standard capacitors of 100 mfd and 2000 mfd are available. These controls were adjusted at the factory and should not require readjustment. However, if you do have the standard capacitors mentioned above and wish to recalibrate, proceed as follows:

NOTE: Be sure line voltage is 117V A.C.

1. Rotate the *Selector* switch to the 100 MFD position.
2. Connect the BLUE test lead to the + terminal of the 100 mfd standard capacitor. Connect the BLACK test lead to the – terminal of the capacitor.

3. Adjust the *Calibrate* control on the front panel for a reading of 100 MFD on top scale.

4. Rotate the *Selector* switch to the CALIBRATE position and adjust the *100 mfd Reference* control for a reading of 100 MFD on top scale.

5. Rotate the *Selector* switch between the 100 MFD position and the CALIBRATE position. Both readings should be identical.

6. Rotate the *Selector* switch to the 2000 MFD position.

7. Remove the 100 mfd standard and insert the 2000 mfd standard in its place, observing the same polarity.

8. Adjust the *2000 mfd Adj.* control for a reading of 2000 mfd on the lower top scale.

9. Remove the 2000 mfd standard from the 801.

DESCRIPTION. See Figure 9.

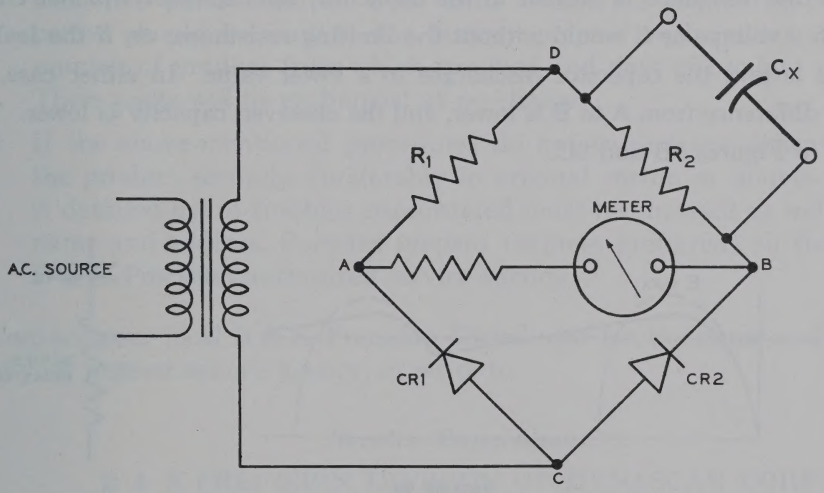


FIGURE 9. SIMPLIFIED SCHEMATIC OF ELECTROLYTIC TEST.

The basic circuit is the bridge shown in Figure 9. Without C_x, a current flows from C to D when the voltage at C is positive with respect to D, that is, over half the cycle. Since each leg is identical, like currents flow from CR_1 and from CR_2 through R_2. The voltage across A to B is zero. When C_x is added, it charges up during the time the current flows through CR_2 and appears as an equivalent battery in series with that leg of the bridge. This causes a voltage difference bewteen A. and B.

Between charging cycles, a portion of the capacitor charge is discharged by R_2 (and the parallel circuit of R_1 in series with the meter resistance). This lowers the average voltage across the capacitor. See Figure 9A. The average voltage (or charge stored in the capacitor) is proportional to the capacity of C_x providing there are no series or shunt leakage paths in the capacitor, thus the voltage difference from A to B may be calibrated in capacity.

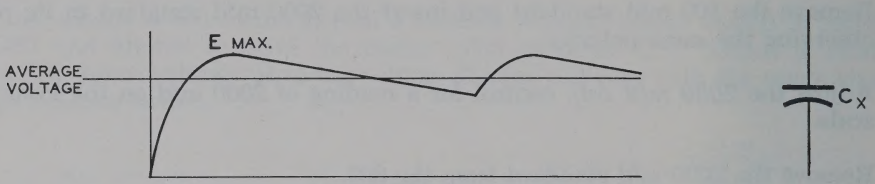


FIGURE 9A.

If a series resistance is present in the capacitor, the capacitor will not charge to as high a voltage as it would without the limiting resistance; or, if the leakage resistance is low, the capacitor discharges to a lower value. In either case, the potential difference from A to B is lower, and the observed capacity is lower. This is shown in Figures 9B and 9C.

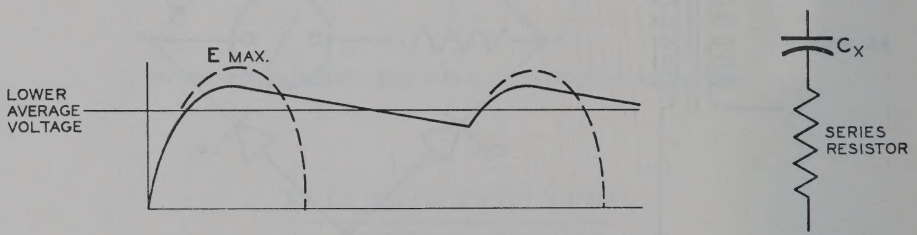


FIGURE 9B

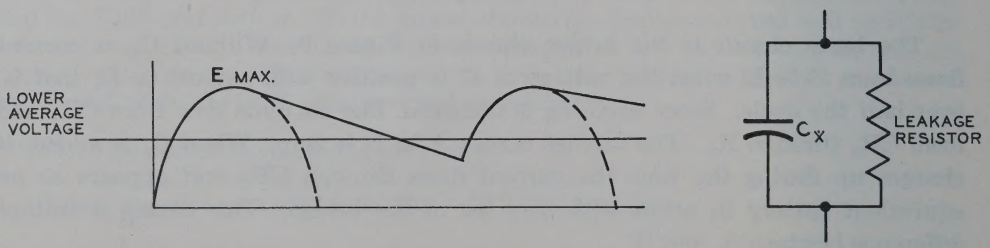


FIGURE 9C.

WARRANTY SERVICE INSTRUCTIONS

1. Refer to the maintenance section of the instruction manual for adjustments that may be applicable.
2. Defective parts removed from units which are within the warranty period should be sent to the factory prepaid with model and serial number of product from which removed and date of product purchase. These parts will be exchanged at no charge.
3. If the above-mentioned procedures do not correct the difficulty, pack the product securely (preferably in original carton or double-packed). A detailed list of troubles encountered must be enclosed as well as your name and address. Forward prepaid (express preferred) to the nearest B & K-Precision authorized service agency.

Contact your local B & K-Precision Distributor for the name and location of your nearest service agency, or write to

Service Department

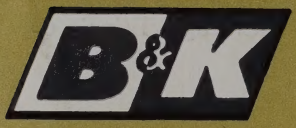
B & K-PRECISION DIVISION OF DYNASCAN CORP.

2815 West Irving Park Road

Chicago, Illinois 60618

ONE YEAR LIMITED WARRANTY

"DYNASCAN warrants that each product manufactured by it will be free from defects in material and workmanship under conditions of normal use and service for a period of one (1) year from the date of purchase from an authorized DYNASCAN distributor. DYNASCAN will, at its option, repair or replace any product or component not conforming with the foregoing warranty and which is returned, transportation prepaid, to our factory or our authorized service contractor. *DYNASCAN shall not otherwise be liable for any damages, consequential or otherwise.* DYNASCAN makes no other express warranties. *Any implied warranties (including any warranty of merchantability) are limited in duration to (1) one year from the date of purchase.* This warranty does not apply to (i) damage resulting from unauthorized alterations and repairs, misuse, negligency or accident; or (ii) damage resulting from improper installation, connection or adjustment otherwise than in accordance with DYNASCAN's authorized Instruction Manual. This warranty is void if the serial number has been altered, defaced or removed. DYNASCAN reserves the right to discontinue any model at any time or change specifications or design without notice and without incurring any obligation. To register this warranty, the enclosed DYNASCAN warranty registration card should be completed and mailed to DYNASCAN CORP., 1801 W. Belle Plaine Avenue, Chicago, Illinois 60613, within ten (10) days after date of purchase.



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